BEVERAGE PORTIONED PACKAGE FOR PREPARING A FOAMY BEVERAGE FROM SOLUBLE POWDER

FIELD OF THE INVENTION

The invention relates to a beverage portioned package with soluble powder for preparing a foamy beverage in an extraction device in which the package is held or clamped and water is injected under pressure therethrough.

BACKGROUND OF THE INVENTION

Foamed beverages, such as espresso, cappuccino or latte can be dispensed from portioned packages that are placed inside a beverage machine. Pre-metered and pre-packed portions of coffee and the like for the preparation of coffee-based beverages facilitate the preparation of the beverage while ensuring that the dose-to-dose quality and strength of the beverage remains constant for the same conditions of preparations (dosage, temperature, pressure, time, etc.). It also provides convenience to the user. The portioned package usually sits in a leak-tight enclosure of an espresso type coffee machine, and hot water is passed under pressure through the portion of coffee. A receiver forming the underside of the enclosure typically collects the beverage.

These packages have been successful for preparing foamy beverages from roast and ground coffee. However, they are not well adapted to prepare, from soluble powder, a beverage with a sufficient solids concentration and decent foam. In this regard, it has been found that the pressure in the portioned package would tend to drop rapidly before the end of the beverage delivery. The drop of pressure is detrimental to a full dissolution of the powder in the package, consequently, it is detrimental to the control of the solids concentration in the final liquid delivered since soluble material does not dissolve entirely and some soluble material remains in the package. Similarly, the pressure being low, less foam is created out of the extraction.

British patent 803,486 discloses a filtering medium for brewing beverages whereby the filter paper is coated with a water-insoluble material so that the paper is rendered non-porous for a period of time. This is intended to assist in the brewing of coffee. This patent, however, does not remedy the deficiencies of the art.

Thus, it is desirable to provide a beverage portioned package containing soluble powder that produces, in a beverage dispensing device supplying water under

pressure, a beverage with high quality characteristics in particular a desired solids concentration and a decent foam. The present invention now does this.

SUMMARY OF THE INVENTION

The invention relates to a beverage-portioned package for preparing a beverage in an extraction device. The package is associated with an extraction device, typically one which holds or clamps the package between a water supplying part and a receiver of the device. The package comprises a first surface for receiving water and allowing the water to flow into and through the package under pressure when the package is operatively associated with the extraction device to form the beverage. The package also has a second surface that allows for the beverage to flow therethrough so that the beverage can be collected in the received of the device. Advantageously, the package contains a water-soluble beverage material in an amount sufficient to form the beverage and a filler. The filler advantageously comprises a water-insoluble material adapted to maintain extraction pressure of the beverage above that which is created by the sole resistance of the first and second surfaces when the package is emptied of the water-soluble material.

The invention also relates to a method of making a foamed beverage from a soluble beverage-forming material in a beverage portioned package that is processed in an extraction device. In this method, the invention offers an improvement which comprises providing the package with a filler therein, with the filler comprising a water insoluble material adapted to maintain extraction pressure of the beverage above that which is created by the sole resistance of the package to facilitate formation of a foam on the beverage that is dispensed from the extraction device.

The filler performs to maintain a sufficient pressure of extraction during extraction of the portioned package while the water-soluble beverage material progressively dissolves in water, as water passes through the package to release the beverage. The pressure inside the portioned package, which can be so maintained at a sufficient level until the portion of soluble material has been dissolved, contributes to ensure that the beverage delivers the desired solids concentration and that a sufficient amount of foam is also created. These properties are significantly improved over portioned packages that do not include such a filler. For packages comprising flexible walls, the filler also acts to maintain the proper volume and size of the package during

and after the extraction process and prevent the package from collapsing in the extraction chamber.

Preferably, the filler is configured for avoiding a drop of the pressure of extraction. Thanks to the filler, the maximum pressure reduction during the extraction of the package can be maintained lower than 0.2 bars, preferably lower than 0.05 bar, until full completion of the beverage delivery.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the present invention will appear more clearly upon reading the following description of preferred embodiments for implementing the present invention, this description being made with reference to the annexed drawings, in which:

Fig. 1 is a cross sectional view along I-I of Fig. 2 of a preferred embodiment of the portioned package of the invention;

Fig. 1A shows a detail of the content of the package of Fig. 1;

Fig. 2 is a top view of the portioned package of Fig. 1;

Fig. 3 is a cross sectional view thereof during water supply in an extraction chamber of the package of Figs. 1 and 2;

Fig. 4 is a cross sectional view similar to Fig. 3 but at the end of the extraction;

Fig. 5 is a cross sectional view of a variant of the package of the invention;

Fig. 6 is a cross sectional view of another variant of the package of the invention;

Fig. 7 shows in cross section a typical espresso device with packages of the inventions;

Fig. 8 is a cross sectional view of a self-sustainable portioned package according to a variant of the invention;

Fig. 9 is a cross sectional view of another self-sustainable portioned package according to another variant of the invention;

DETAILLED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In a preferred aspect of the invention, the filler forms a pressure resistance bed in the package. A pressure resistance bed is meant to be a relatively homogeneously distributed mass of filler in the content of the package. The pressure resistance bed may be either made of discrete particles of water-insoluble material forming at least

one or multiple layers or, alternatively, thoroughly mixed with the water-soluble material. The bed may also be a continuous network of water-insoluble material, which acts to generate the stabilized extraction pressure when water is forced to pass it. The pressure resistance bed preferably extends through at least 95% of the transverse section of the package, preferably through 100% of the transverse section of the package, in order to avoid creating privileged water paths or holes after dissolution of soluble material. Such paths or holes would indeed cause a significant pressure drop with consequence on dissolution and foam generation. Preferably, the pressure resistance bed extends through at least 30 %, preferably 60%, even most preferably 100% of the thickness of the package. The thickness of the package is meant to be the larger distance that separates the second surface from the first surface of the filled package.

The pressure resistance bed can preferably be a mass of discrete pieces in the form of powder, particulates, granules, flakes, fibers or combinations thereof. As noted, the pieces may preferably be thoroughly mixed with the water-soluble material. The bed can also form one or more transverse layers distinct from the soluble powder; i.e., extending across the direction of the flow between the first and second surfaces and preferably in an essentially perpendicularly arrangement. At least one layer of filler and one layer of water-soluble powder can be so arranged in a configuration of superimposed layers in the enclosure of the package.

The preferred pressure resistance bed is made of powder having a particle size that is below 600 microns. Even more preferably, the particle size of the powder is between 200 and 500 microns, and most preferably between 250 and 400 microns. Above 600 microns, the water tends to drain too easily between the powder grains as the soluble powder starts being washed by the water. As a consequence, no sufficient pressure can be maintained over the extraction time. Below 200 microns, the powder bed is too compact so that the resistance becomes too high and water does not freely move through the package.

In an alternative, the pressure resistance bed can be at least one continuous porous member such as a web, a mat, a sintered piece, a piece of foam or a compacted piece. The member can be made of any organic or inorganic insoluble material. The porosity of the continuous member should preferably be between 10 and 200 microns, even more preferably between 20 and 60 microns. The continuous member or an assembly of several members has to cover the entire transverse section of the package

in order to avoid leaving privileged paths for water. The continuous member can have any shapes such as a bar, a disc, a polygonal or other sorts of shapes. Soluble powder can be inserted inside the interstice or pores of the member. For instance, soluble powder and the filler from insoluble powder can be compacted, extruded or sintered to form a complete solid block which fills the enclosure of the package.

The preferred embodiment has a filler with water absorption properties such that it can absorb the residual water in the extraction device at the end of the extraction. Therefore, the package can be removed from the device without much water dripping thus avoiding the creation of an unpleasant messy place. For that, the preferred filler has water absorbent properties such that the water absorbency rate of the package is at least 200%, more preferably, between 210 and 245%. The water absorbency rate is measured with a package being emptied from the water-soluble material. The rate corresponds to the formula (X2.100)/X1, wherein X2 is the weight of the final package after being soaked in hot water during 30 seconds and X1 being the weight of the same dry package.

In a preferred embodiment, the filler is chosen among the group consisting of cellulose, fiber, fresh ground coffee, spent ground coffee and combinations thereof. These work well when the water-soluble material includes soluble coffee powder, milk powder, a creamer substitute powder, chocolate powder and mixtures thereof.

Preferably, the ratio water-soluble material to filler, in volume, is between 1:0.5 and 1:10, preferably between 1:1 and 1:8 and most preferably between 1:1 to 1:6 (by volume). The particular ratio is very dependent on the nature of the water-soluble material or mixture of water-soluble materials. For instance, for pure soluble coffee, the ratio is most preferably between 1:2 to 1:6, whereas for milk and coffee mixes, creamer and coffee mixes or chocolate mixes, the ratio would be lower and most cases preferably between 1:1 to 1:3 (by volume).

When the water-soluble powder comprises coffee, its amount is determined to provide at least 10 wt %, preferably, 40 wt %, of the total coffee solids in the final beverage.

In another embodiment, the filler may contain a soluble and/or water extractable substance for concentrating in solids and/or aromatizing or flavoring the beverage. Thus, it offers the opportunity to contribute to the solids concentration of the beverage and/or supply additional aroma or flavor characteristics to the beverage which would not possible with the sole use of the water-soluble powder. By adding more coffee

solids, for example, the character and strength of the beverage can modified accordingly. It also offers the opportunity to more easily customize the beverage to different consumer's taste and needs by having a limited number of water-soluble powders to which is added a range of differently aromatizied or flavored fillers in order to provide a wide range of beverages. Examples of desirable flavors include hazelnut, vanilla or chicory beans.

In a preferred embodiment, the first and second surfaces are water permeable walls. For instance, the surfaces may be made of filter paper sheets. More specifically, the first and second surfaces are disc shaped sheets manufactured from filter paper and which are interconnected adjacent a longitudinal edge; the interconnected part of the sheet forming an annular sealing seam. Such an outer package configuration is typically known under the usual denomination of "filter pod".

In an alternative, the first and second surfaces may be solid or semi-solid walls which are pre-opened or pierceable. In that case, the first and second surfaces can be made of plastic, a metal such as aluminum or an aluminum alloy, or combinations thereof.

Referring to Figs. 1-2, a preferred embodiment of a package constructed according to the invention is a filter pod 1. The pod 1 includes a pair of permeable walls 10, 11 intended to form a water entry surface and a water exit surface. The walls 10, 11 are sealed together at their peripheral edge along an annular sealing seam 12 delimiting an internal enclosure. This seam also allows the package to be held in the extraction device. The pod may be symmetrical with respect to its median plane passing along the seam 12 thereby providing a package which can be installed in an extraction device regardless of the top/bottom positioning of the first and second surfaces of the pod. The sealing seam can be formed by hot welding or adhesion or any other suitable technique able to create a strong bond resisting to hot water pressure. The filtering paper sheets is preferably sheets of diameter comprised between 10 to 100 mm, preferably 30 to 70 mm, with dry tensile strength of between 50 to 200 g/mm and a wet tensile strength of between 20 to 100 g/mm.

According to the invention, the package is filled, preferably along the entire cross sectional area of the enclosure, with, firstly, a water-soluble beverage material indented to provide the primary beverage ingredient for the beverage which is delivered through the extraction device, and secondly, with a filler intended to provide a pressure resistance means for retaining pressure during the progressive dissolution

of the water-soluble beverage material during extraction. The portion of water-soluble beverage material is intended to thoroughly mix with water during extraction. For a good dissolution and mixing with water, the pressure in the package must be maintained at substantially stable level over the extraction. The role of the filler is to keep the pressure of extraction substantially high until the dissolution is over.

The water-soluble beverage material can be chosen amount the group of soluble coffee powder, milk powder, creamer powder, cocoa powder and mixtures thereof.

The preferred embodiment comprises soluble coffee powder able to provide espresso type coffee or larger coffee servings. Soluble coffee powder includes spray-dried coffee powder, freeze dried coffee powder and combinations thereof. This soluble coffee powder may be aromatized coffee powder as obtained by the process for the recovery of aroma components from roasted and ground coffee as described in US patents 6,592,922 and 6,455,093, the contents of each of which is expressly incorporated herein by reference thereto. In an alternative, the soluble coffee powder can be non-aromatized coffee powder.

Soluble coffee powder may be used in a blend with milk or creamer powder in varying amounts depending upon the final whitened beverage desired. The ratio soluble coffee powder to milk or creamer powder may vary from 1:10 to 10:1.

According to the invention, the filler may be any food and/or non-food water-insoluble material. The proportion of water-insoluble material of the filler should be of at least 95%, preferably 100% by weight of the filler. The water-soluble part of the filler would usually be coffee solids, aroma, flavors, carbohydrates, etc. For example, the filler can be made of water-insoluble carrier coated or impregnated with water-soluble or extractable substances under hot water pressure which is (are) delivered to aromatize, sweeten or modify otherwise the final attributes of the beverage. The soluble and/or extractable substances may also be releasable coffee substances which contribute to the set up of the final concentration in coffee solids in the beverage.

In preferred embodiments, the filler includes cellulose, fiber, fresh ground coffee or spent ground coffee.

Cellulose is typically plant or wood cellulose under the form of powder or short fibers. An example of a suitable cellulose is cottonseed flour. These fibers can be organic or inorganic fibers. Organic fiber can be food fiber from vegetal or animal origin. Inorganic fiber must be food grade fiber and must comply with food

regulations. Well known compliant materials include certain plastics, glass or ceramics.

For economic reasons and food regulation compliance, a preferred filler is spent ground coffee powder. Spent ground coffee powder is mainly coffee fiber which is obtained from fresh ground coffee which has been brewed or extracted to eliminate coffee solids and coffee aromas. Spent ground coffee is a common coffee waste obtained in the manufacturing of the soluble coffee powder. Spent ground coffee can also be an excellent carrier for releasing aromas and flavors.

Fresh ground coffee may also be used as the filler in order to provide natural coffee solids and aroma to the beverage. Since the primary purpose of the filler is to provide the pressure resistance function, the use of ground coffee as a filler should be limited to a contribution of coffee solids in the final beverage being not above 30% of the total solids concentration of the package.

Fillers having swelling properties by water absorption are preferred. More preferably, the filler should be able to absorb water to an extent such that it progressively replaces the volume of soluble powder which is removed by water dissolution. Therefore, the size and volume of the package can be substantially maintained constant in the dispensing device with as small an amount of voids as possible. Lesser voids enable the package to maintain pressure resistance at the required level all over the extraction. The maintenance of the size and shape of the pod also contributes to a proper holding in the machine. A loss of volume after extraction should not exceed 20% of the initial volume, more preferably it should be less than 10%, most preferably it should be less than 5% of the initial volume of the package.

Another important advantage of the water absorption properties of the filler lies in the fact that, after extraction, the pod can be removed with a lesser dripping of water. The pod is therefore cleaner and more convenient to use. The swelling characteristics of the filler can vary depending on the nature of the beverage soluble powder. For instance, because milk powder usually occupies a larger volume than coffee powder, a filler swelling more is preferred to re-occupy properly all the voids left by the milk progressively dissolving. The filler will preferably act as a sponge which expands as more water comes in and more soluble material is removed from the package.

According to the embodiment of Figs 1-3, the filler constitutes a powdery pressure resistance bed 20 in which is thoroughly mixed water-soluble powder 30 such as soluble coffee. Figs 1A shows the structure of the bed with soluble powder in it. The preferred volume ratio of water-soluble powder to filler is comprised between 1:1 and 1:8, most preferably 1:2 to 1:5. The volume herein refers to the non-compacted and non-tapped volume of bulky material measured in a standard volumetircally graduated cylinder. For example, the typical total volume for one single serving coffee pod represents about 25 mL. The optimal volume of soluble coffee represents thus about 5-7 mL, whereas the volume of filler represents about 20-18 mL.

Preferably, the particle size of the filler is lower than the particle size of the beverage soluble powder. Finer particles for the filler contribute to reduce the voids in the mass of the bed. Finer particles also re-distribute also more efficiently in the voids left by the soluble particles which have dissolved in water. Preferably, the mean particle size of the filler ranges between 200 and 600 microns, most preferably between 250 and 450 microns. For example, typical spent ground coffee has a mean particle size of about 280 to 400 microns.

Fig. 3 shows the package of the invention as sitting in a beverage preparation assembly 3. The assembly for use in a beverage preparation device or coffee machine comprises a receiver 30 for receiving the pod 1 of the invention in an inner space 31 of the receiver. The inner space 31 can be a bowl-shaped design bounded by a bottom wall 32 and sidewall 33. The inner space is shaped to the general contour of the package. Because in this example, the inner space 31 and the pod 1 are of circular design, this implies that the receiver comprises a single cylindrical sidewall 33 which is round and closed in itself. Other shapes of receivers can be contemplated such as square, polygonal, etc.

Located in the bottom of the receiver is at least one outflow opening 34. The outflow can taper to a restriction 35 in order to form a jet for delivering the beverage in the cup. This restriction 35 enables to restrict the flow of the beverage and provides a foam of higher volume. The restrictor has usually a diameter of less than 1 mm. However, because of the use of the package of the invention with a built-in pressure resistance means, the restrictor can be avoided. In particular, for pods of large volume, e.g., more than 30mL, where more food substance is required such as for milk and coffee mixes or cocoa powder mixes, there is an advantage to avoid the restrictor and

to deliver at a higher flow rate than for smaller volumes, in order to meet an acceptable delivery of less than 60 seconds, more preferably of less than 45 seconds. In that event, the filler contributes to create the foam without the need of the restrictor.

The assembly is closed at the opposite of the receiver around the pod by water supply part 40. This part covers the upper surface of the pod 1 to form with the receiver a dissolution chamber 5. The water supplying part cooperates also with a peripheral sealing joint 41 to maintain the chamber tight. For this, the sealing joint 41 is pressed on the seam or peripheral edge of the pod. A preferred water supplying means can be a hose 42, or a shower with multiple water outlets (no shown) or any other equivalent means. The receiver 30 is detachably attached to an upper portion of the extraction chamber, and can be connected therewith with any suitable detachable connection means.

As hot water starts being supplied through the water supplying means by a pump, the pressure inside the package rapidly increases due to the resistance provided by the filler.

The preferred package enables a rapid rise to the pressure of extraction, then, a relatively stable pressure of extraction until the water pump is stopped at the end of the extraction. The rise of pressure up to the pressure of extraction is typically of less than 10 seconds, preferably less than 8 seconds, even most preferably less than 6 seconds. The stabilized pressure of extraction depends not only on the filler (particle size, amount, nature of the filler, etc.) but also on the characteristics of the machine (strength of the pump, tightness, etc.). The stabilized pressure of extraction may range from 1.5 to 12 bars, more typically, from 1.8 to 6 bars.

As the extraction and dissolution process goes, less and less water-soluble powder is left in the package, as shown in Fig. 4, and filler swells to occupy the corresponding freed volume so that the pressure in the chamber of extraction can be maintained substantially constant. The beverage dilution is controlled by the amount of water delivered (water flow rate by water delivery time). The water pump is stopped when the proper water dilution of the beverage in the cup is achieved. Water flow can be maintained beyond the total dissolution of the water-soluble powder if the beverage needs further dilution, such as for a large or long cup of coffee, i.e., 110 mL of beverage in the cup.

After the process is over, the assembly can be opened and the spent package is removed from the receiver. Due to the presence of the filler that scavenges the

residual water from the extraction chamber and the receiver through the filtering paper sheets, the pod can be cleanly removed with less water dripping during removal.

Fig. 5 shows a variant of the pod of the invention. The filler can be formed from several individual water-insoluble layers 150, 151 which are separated from layers of beverage water-soluble powder 160, 161, 162. The layers of filler 150, 151 are oriented transverse to the direction of the flow and extend over the entire cross section of the package so that all water is forced to pass through these layers and a proper pressure can be maintained all over the extraction process.

Fig. 6 shows another variant in which the filler is formed from a porous block 17 comprising a sintered, compacted or foamed water insoluble material. The block can hold the beverage powder 18 in pores or interstices. Depending upon the material of the block, the beverage powder can be introduced into the block by powder compaction technology, sintering technology or foam technology.

The package of the invention can be extracted in any traditional espresso machine with an extraction assembly such as one illustrated in Fig. 7. The assembly of Fig. 7 is known and comprises a lower collector 70 with a large hole 71, a package receiver 72 with a plurality of beverage outlets. The package receiver is an adaptor which can be sized to accommodate one package or two packages at a time depending on the volume and/or strength of beverage desired. The assembly further has an upper fluid supplying cover 73 with water inlets 74 which co-acts with the collector and receiver in tight closure. The difference with the extraction assembly of Fig. 3 primarily lies in the absence of restrictor which is no more desirable for the larger volume beverages.

The package of the invention is not limited to a supple envelope of filtering paper walls. Fig. 8 shows, for example, a package 8 comprising a semi-flexible cup shaped package. The package includes a cup 80 with a bottom base 81 provided with multiple beverage outlets 82 and a puncturable membrane 83 or lid welded and/or crimped along outer edges 84 of the cup. According to the invention, the cup and the membrane or lid delimits an enclosure for the water-soluble beverage powder and the filler.

Fig. 9 is another variant of a cup-shaped package 9 comprising a cup 90 onto which is sealed an apertured membrane or lid 91. The difference with the embodiment of Fig. 8 lies in the package having an integrated collector element 92 that can condition the foam to the correct bubble size range and direct the flow of beverage to

the cup. The collector can be permeably closed by a filter 93 when the filler 20 is in powdery form. However, the filter 93 may be removed when the filler 20 is porous but in one sufficiently large block in the enclosure.

EXAMPLE

A pod was made using 4.5 g spent coffee ground to 390 microns and 2 grams of soluble coffee. The ingredients were mixed thoroughly and sealed in two layers of disc-shaped filter paper with a diameter of 69 mm, a dry tensile strength of 180 gram per millimeter. This pod was used to prepare a black coffee beverage of 120 mL with a layer of foam of about 15% of the volume beverage.